

1. Find the exact value of each expression.

a. $\sin\left(\frac{2\pi}{3} + \frac{3\pi}{4}\right) = \sin\left(\frac{2\pi}{3}\right)\cos\left(\frac{3\pi}{4}\right) + \cos\left(\frac{2\pi}{3}\right)\sin\left(\frac{3\pi}{4}\right)$
 $= \left(\frac{\sqrt{3}}{2}\right)\left(-\frac{\sqrt{2}}{2}\right) + \left(-\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$
 $= -\frac{\sqrt{6}}{4} + -\frac{\sqrt{2}}{4} = \frac{-\sqrt{6} - \sqrt{2}}{4}$

not the same!

b. $\sin\left(\frac{2\pi}{3}\right) + \sin\left(\frac{3\pi}{4}\right)$
 $= \left(\frac{\sqrt{3}}{2}\right) + \left(\frac{\sqrt{2}}{2}\right)$
 $= \frac{\sqrt{3} + \sqrt{2}}{2}$

not the same

★ Do NOT "distribute" a trig function!

2. Use the sum and difference formulas to find the exact value.

$\sin 165^\circ$

$165^\circ = 120^\circ + 45^\circ$

$165^\circ = 210^\circ - 45^\circ$

$\sin 165^\circ = \sin(120^\circ + 45^\circ)$

$= \sin(120^\circ)\cos(45^\circ) + \cos(120^\circ)\sin(45^\circ)$

$= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(-\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$

$= \frac{\sqrt{6}}{4} + -\frac{\sqrt{2}}{4} = \frac{\sqrt{6} - \sqrt{2}}{4}$



$\sin 165^\circ = \sin(210^\circ - 45^\circ)$

$= \sin(210^\circ)\cos(45^\circ) - \cos(210^\circ)\sin(45^\circ)$

$= \left(-\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) - \left(-\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$

$= -\frac{\sqrt{2}}{4} - -\frac{\sqrt{6}}{4} = \frac{-\sqrt{2} + \sqrt{6}}{4}$



3. Use the sum and difference formulas to find the exact value.

$$\begin{aligned} \frac{13\pi}{12} &= \frac{10\pi}{12} + \frac{3\pi}{12} \\ &= \frac{5\pi}{6} + \frac{\pi}{4} \end{aligned}$$

$$\sin \frac{13\pi}{12}$$

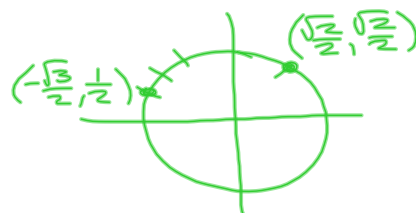
$$= \sin \left(\frac{5\pi}{6} + \frac{\pi}{4} \right)$$

$$= \sin \left(\frac{5\pi}{6} \right) \cos \left(\frac{\pi}{4} \right) + \cos \left(\frac{5\pi}{6} \right) \sin \left(\frac{\pi}{4} \right)$$

$$= \left(\frac{1}{2} \right) \left(\frac{\sqrt{2}}{2} \right) + \left(-\frac{\sqrt{3}}{2} \right) \left(\frac{\sqrt{2}}{2} \right)$$

$$= \frac{\sqrt{2}}{4} + \frac{-\sqrt{6}}{4}$$

$$= \frac{\sqrt{2} - \sqrt{6}}{4}$$



4. Find the exact value of each trigonometric function, given:

$$\sin u = \frac{4}{5}, \text{ where } 0 < u < \frac{\pi}{2} \text{ and}$$

$$\cos v = -\frac{12}{13}, \text{ where } \frac{\pi}{2} < v < \pi.$$



$$\begin{aligned} \text{a. } \sin(u + v) &= \sin u \cdot \cos v + \cos u \cdot \sin v \\ &= \left(\frac{4}{5} \right) \left(-\frac{12}{13} \right) + \left(\frac{3}{5} \right) \left(\frac{5}{13} \right) \\ &= \frac{-48}{65} + \frac{15}{65} = \frac{-33}{65} \end{aligned}$$

$$\begin{aligned} \text{b. } \sin(u - v) &= \sin u \cdot \cos v - \cos u \cdot \sin v \\ &= \left(\frac{4}{5} \right) \left(-\frac{12}{13} \right) - \left(\frac{3}{5} \right) \left(\frac{5}{13} \right) \\ &= \frac{-48}{65} - \frac{15}{65} = \frac{-63}{65} \end{aligned}$$